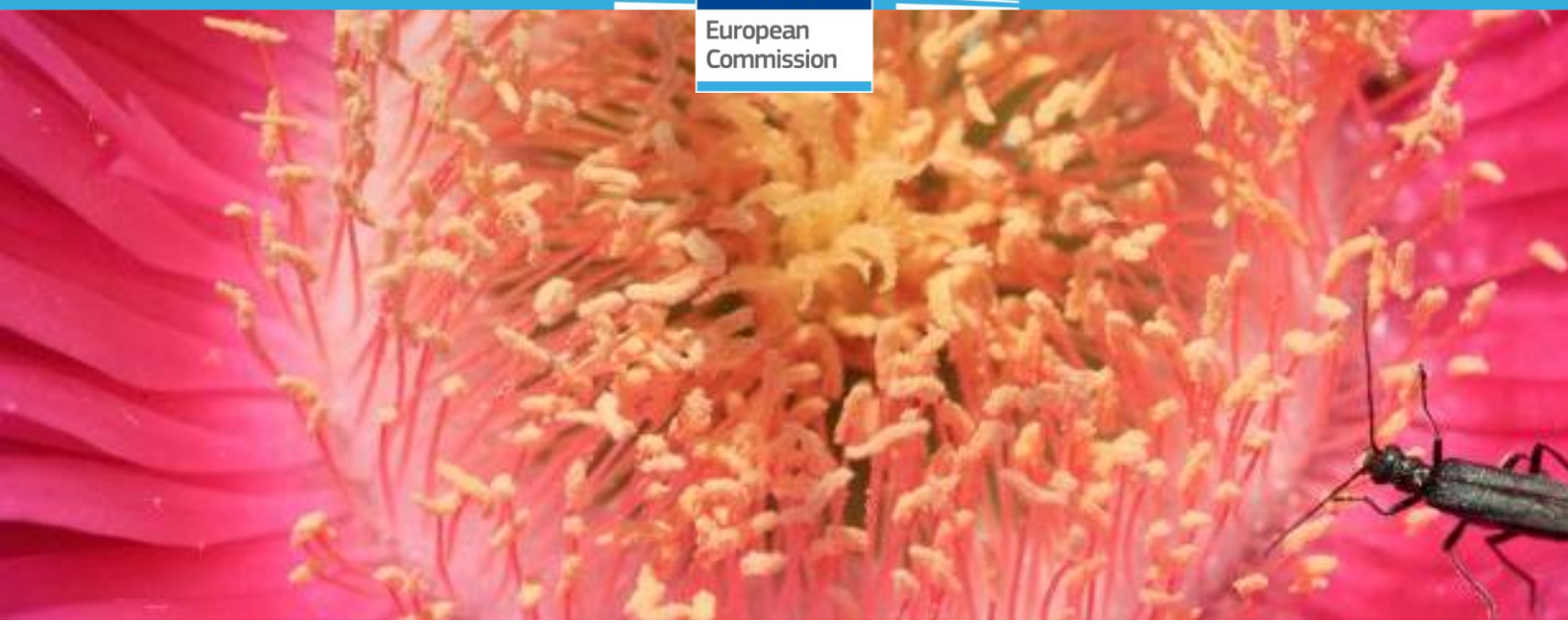

JRC TECHNICAL REPORTS

ILCD Data Network and ELCD Database: current use and further needs for supporting Environmental Footprint and Life Cycle Indicator Projects.

Marco Recchioni, Fabrice Mathieux,
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ILCD Data Network and ELCD Database: current use and further needs for supporting Environmental Footprint and Life Cycle Indicator Projects.

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1 Executive summary

1.1 Overview

Life Cycle Thinking (LCT) and Life Cycle Assessment (LCA) are the scientific approaches behind modern environmental policies and business decision support related to Sustainable Consumption and Production (SCP). A key common need for the use of the LCA methodology is the availability of independently reviewed and quality-assured, consistent data that are made to fit the purpose (UNEP - SETAC Life Cyle Initiative, 2011). This is where the International Reference Life Cycle Data System Data Network (ILCD DN) and the European Reference Life Cycle Database (ELCD)(European Commission, 2010a) come in place to support this effort.

The Environmental Footprint (EF) guides (European Commission, 2012f; European Commission, 2012e) and the Life-Cycle Indicators (LC Indicators) framework (European Commission, 2012b) have been developed as building blocks of the Flagship initiative "A Resource-Efficient Europe" (European Commission, 2011) which proposes ways to increase resource productivity and to decouple economic growth from both resource use and environmental impacts taking a life-cycle perspective. At this stage, it is crucial to guarantee coherence and consistency on the application of these key methodologies and frameworks. The aim of this report is to investigate the current use and needs of the ILCD DN and of the ELCD supporting the EF and the LC Indicator projects providing coherent data increasing their usability and consistent application to the European context. Recommended future development have been investigate and reported as well.

1.2 ELCD and ILCD DN

Since its first launch in 2007, the ELCD has been providing free-of-charge well documented Life Cycle Inventory (LCI) data on resource consumption and emissions for many processes. The current ELCD II contains LCI data for over 300 Processes. ELCD III, to be officially launched at the start of 2013, will raise the number of datasets to around 440. Moreover, many datasets of the ELCD III are being reviewed against the ILCD Entry-Level requirements. This, together with the ILCD Data Network IT infrastructure, will allow to set-up an ELCD node as part of the ILCD Data Network.

The ILCD Data Network is a web-based infrastructure allowing convenient online access to consistent and quality-assured life cycle inventory (LCI) data sets from various providers, globally. The ILCD Data Network is hence designed as one-stop-shop for life cycle data in a policy and business context. Datasets quality within the ILCD DN is ensured by the development of the ILCD Entry-Level requirements. The compliance to these requirements is a pre-requisite for the registration to the ILCD DN resulting in the selection of well documented and reviewed data sets.

1.3 Recommended data-related initiatives supporting EF

Secondary data availability is a crucial aspect allowing performing EF studies. ELCD data sets cover manly basic commodities (materials, energy carriers) and services (transport, storage, end-of-life treatment) commonly used in many LCA studies. Nevertheless datasets availability should be increased. The launch of a public "Call for Data" (specially involving the members of the EPLCA Business advisory

group) can potentially be useful to achieve this goal. Datasets owner should set up an ILCD DN node and submit datasets to the ILCD DN. This should be a mandatory requirement in the "Call for Data".

Both PEF and OEF guides clearly consider the data quality as a key aspect to be taken into account while selecting data to be used within an EF study. Six quality criteria are adopted for EF studies, five related to the data and one to the method. In order to meet EF quality requirements it is suggested to update/revise some ELCD datasets, improving the documentation and uncertainty and completeness quality, in the mid-term period. In order to facilitate data quality evaluation within an EF study, it is recommended to ask reviewers of datasets to pre-evaluate the purely data set-specific quality criteria (i.e. completeness, Precision/uncertainty and methodological appropriateness and consistency) at the review stage and publish these results on the review reports. This can be achieved with a minor revision of the ILCD Entry-Level review template.

As the compliance with ILCD format, documentation and nomenclature are enforced in EF requirements, and in order to increase the availability of more quality-assured datasets, it is recommended to support the development of flows mapping files or conversion tools between other commonly accepted LCI data formats and the ILCD format.

As the ILCD DN is based on the ILCD Entry-Level requirements that may differ to the EF ones, it is also suggested to develop in the future parallel Data Networks, each network using its own quality requirements. The following parallel data networks are currently foreseen:

- 1 data network for the ELCD (virtual distributed DB);
- 1 ILCD Data Network, using the ILCD Data Network entry-level requirements;
- 1 PEF Data network, using the EF quality requirements;
- n (P/O)EFCRs specific data networks, using n FCR specific quality requirements.

1.4 Recommended data-related initiatives supporting LC Indicators

LCI Indicators framework refers to various ILCD components, in particular the ILCD nomenclature and recommended LCIA methods. The evaluation of the LC Indicators is based on the use of secondary data and their availability has been taken into account selecting the products/sectors included in the prototypes. In order to increase the number of the considered products and to overcome some methodological limitations, additional and more specific data sets should be developed in the future. Moreover, in view of capturing the overall environmental impacts of traded products, the referenced LCI data should be more and more country-specific (European Commission, 2012b). The launch of a public "Call for Data" (similar the one mentioned for EF) can potentially be useful to achieve this goal, and to generally increase the data availability. The involvement of member state LCA national network and National Databases providers in the ILCD DN is recommended in order to increase the availability of more representative country specific LCI data sets.

The use of the ILCD reference elementary flow list and the ILCD nomenclature in the LC Indicators project facilitates the use of the ILCD Format. A key currently on-going task concerns development of ILCD data sets to store data within the project. While LCI inventories data can be implicitly stored in the ILCD format, LCIA results data sets may be produced to increase the ability to share result with stakeholders. So called "Impact results flows" may be developed in the future to support the development of LCIA results data sets.

Data quality plays a fundamental role in developing reliable sets of indicators. In general, and for updates of the LC Indicators project in particular, referencing ILCD Data Network Entry-Level requirements will ensure an independent evaluation of the achieved data quality, including representativeness and possible uncertainties.

2 Introduction

Life Cycle Thinking is fundamental in the Integrated Product Policy of 2003, (European Commission, 2003) which mandated the development of the ILCD Handbook, the ELCD database, and the LCA Resources Directory (Javier Sanfélix, 2012). It is an important part of assessments behind the Waste framework Directive (European Parliament, 2008) and Ecolabel regulation (European Union, 2010), which explicitly refers to the ELCD. It is also becoming vital in the context of policy analysis, monitoring, to ensure that impacts associated with imported goods and services are taken appropriately into consideration.

The 2011 Communication on "A resource-efficient Europe – Flagship initiative under the Europe 2020 Strategy" (European Commission, 2011) takes these developments to the next stage. This Communication promotes a life cycle approach to reduce the environmental impacts caused by resource use in the whole of the EU. This Flagship Initiative restates the necessity to work with a consistent analytical approach.

The ISO 14040 and 14044 standards provide the indispensable framework for Life Cycle Assessment (LCA). This framework, however, leaves the individual expert with a range of influential choices, which can unnecessarily affect the reliability and comparability of the results of an assessment. Similarly, life cycle data from different sources can methodologically differ widely and are often incompatible in current practice, while generally no single data sources can support all assessment needs. A key common need for a successful implementation of all these policies is the availability of independently reviewed and quality-assured, consistent data that are made to fit the purpose (UNEP - SETAC Life Cyle Initiative, 2011). This is where the International Reference Life Cycle Data System Data Network (ILCD DN) and the European Reference Life Cycle Database (ELCD) but also the various supporting tools, templates and basic data elements come in place to support this effort.

While flexibility is essential in responding to the large variety of questions addressed with LCA, further guidance is needed. Taking into account this, the ILCD Handbook and the Environmental Footprint (EF) Guides have been developed to provide the basis for this guidance to ensure greater coherence in the LCA methodology application in the European context.

The life cycle perspective offers a global perspective. It is therefore appropriate to approximate the potential environmental impacts of consumption and production within and outside Europe, taking into account not only domestic activities. On this basis a framework, methodology, data basis and updating procedure for three Life Cycle Indicators (LC Indicators) sets: resource indicators (European Commission, 2012c), basket-of-products indicators (European Commission, 2012a), Waste management indicators (European Commission, 2012d).

At this stage, it is crucial to guarantee coherence and consistency on the application of these key methodologies and frameworks. The aim of this report is to investigate the current use and needs of the ILCD DN and of the ELCD supporting the EF and the LC Indicator projects providing a coherent data basis increasing usability and consistent application to the European context. Recommended future development have been investigate and reported as well.

3 ELCD and ILCD Data Network: presentation and current state of development

3.1 The ELCD database: towards version III

Since its first launch in 2007, the ELCD has been providing free-of-charge well documented Life Cycle Inventory (LCI) data on resource consumption and emissions for many processes. The current ELCD II contains LCI data for over 300 Processes. ELCD data sets cover manly basic commodities (materials, energy carriers) and services (transport, storage, end-of-life treatment) commonly used in many LCA studies. These datasets are representative for the European market, some data sets are provided country-wise for all 27 EU Member States. The data sets stem are provided as much as possible by European-level business associations. The data sets are conform to ISO 14044 and documented in the ILCD format (European Commission, 2010d), using ILCD reference elementary flows (European Commission, 2010b).

ELCD III, to be launched at the start of 2013, will raise the number of datasets to around 440. Moreover, many datasets of the ELCD III are being reviewed against the ILCD Entry-Level requirements (European Commission, 2010c). This, together with the ILCD Data Network IT infrastructure for the ELCD III, will allow to set-up an ELCD node as part of the ILCD Data Network.

3.2 The ILCD Data Network

The ILCD Data Network (currently under demonstration, to be launched early 2013) is a web-based infrastructure allowing convenient online access to consistent and quality-assured life cycle inventory (LCI) data sets from various providers, globally. The network strongly builds on web 2.0 technologies (API, XML, RESTful services, etc.). Data sets can be documented in any language; a common set of emission and resource flows as well as a common format supports IT-compatibility.

The network is open and any data developer from any country and any kind of organisation can join. Metadata on datasets has to be accessible by anyone but data on input and output flows can be offered for free, for fee, for members only, etc. Businesses, governments, academia, and consultancies worldwide can hence provide their data to this decentralised network, based on their own licensing and financial conditions. The ILCD Data Network is hence designed as one-stop-shop for life cycle data in a policy and business context.

Datasets quality within the ILCD DN is ensured by the development of the ILCD Entry-Level requirements(European Commission, 2010c). The compliance to these requirements is a pre-requisite for the registration to the ILCD DN resulting in the selection of well documented and reviewed data sets.

ILCD DN will be officially launched at the beginning of 2013 with a few initial partners. The ILCD DN will then further expand, with more nodes and more quality-assured datasets to be registered into the Data Network.

4 How ELCD and ILCD D N LCI data can support the environmental Footprint?

4.1 Brief introduction to the Environmental Footprint

The Environmental Footprint (EF) is a multi-criteria measure of the environmental performance of goods/services (Product Environmental Footprint – PEF (European Commission, 2012f)) and goods/services-providing Organisation (Organization Environmental Footprint – OEF (European Commission, 2012e)) from a life cycle perspective.

Both the OEF and the PEF provide a life-cycle approach to quantifying environmental performance. Whereas the PEF method is specific to individual goods or services, the OEF method applies to organisational activities as a whole – in other words, to all activities associated with the goods and/or services the organisation provides from a supply chain perspective (from extraction of raw materials, through use, to final waste management options). Organisation and Product Environmental Footprinting can therefore be viewed as complementary activities, each undertaken in support of specific applications.

EF studies may be used for a variety of purposes, including: benchmarking and performance tracking; least environmental-cost sourcing (i.e. supply chain management); mitigation activities; and participation in voluntary or mandatory programmes. To the extent possible, the OEF should also be applicable within the context of Eco-management and Audit Schemes (EMAS (European Parliament, 2009)).

EF is also intended to directly support comparisons or comparative assertions (i.e. environmental claims regarding the superiority or equivalence of one organisation a competing organisation providing the same products (based on ISO 14040:2006)). This will require the development of additional Product Environmental Footprint Category Rules (PEFCRs) and Organisation Environmental Footprint Sector Rules (OEFSRs) in complement to the more general guidance in order to further increase methodological harmonisation, specificity, relevance and reproducibility for a given product category/sector. PEFCRs and OEFSRs will furthermore facilitate focusing on the most important parameters, thereby also reducing the time, efforts and costs involved in completing an EF study.

4.2 Supporting the typology of LCI data required by EF

4.2.1 Typology of LCI data required by EF

The EF guide requires that specific data shall be obtained for all foreground processes and for some relevant background processes, where appropriate. Secondary data should be used only for foreground processes in EF studies. Secondary data are also used for Infrastructure processes. The need to collect specific data will be better specified in upcoming PEFCRs and OEFSRs documents.

Specific collected data refers to data directly measured or collected, representative of core processes (foreground) at a specific facility or set of facilities. This data is collected directly “on-site” or directly collected from suppliers. According to EF Guide, this data should be collected for all relevant foreground processes.

Secondary data refers to data that is not directly collected, measured, or estimated, but rather sourced from a third-party life cycle inventory database or other source that complies with the data quality requirements of the Environmental Footprint method. Secondary data can be collected for Background processes when no specific collected data are available and when not further rules are specified in PEFCR or OEFCR. In this report, "secondary data" is further divided into two types of data:

- Product/Sector Specific Data (PSSD): it refers to data that are used for all processes that are product or organization specific (e.g. the production pulp is involved in paper products Life-Cycle);
- Cross-Sectorial Secondary Data (CSSD): it refers to data that is used for processes that are common to Life-Cycle of several kinds of products or organizations. Typical CSSD concern energy carrier production, packaging production and transportation processes.

A typical distribution of this data typology is given by Figure 1.

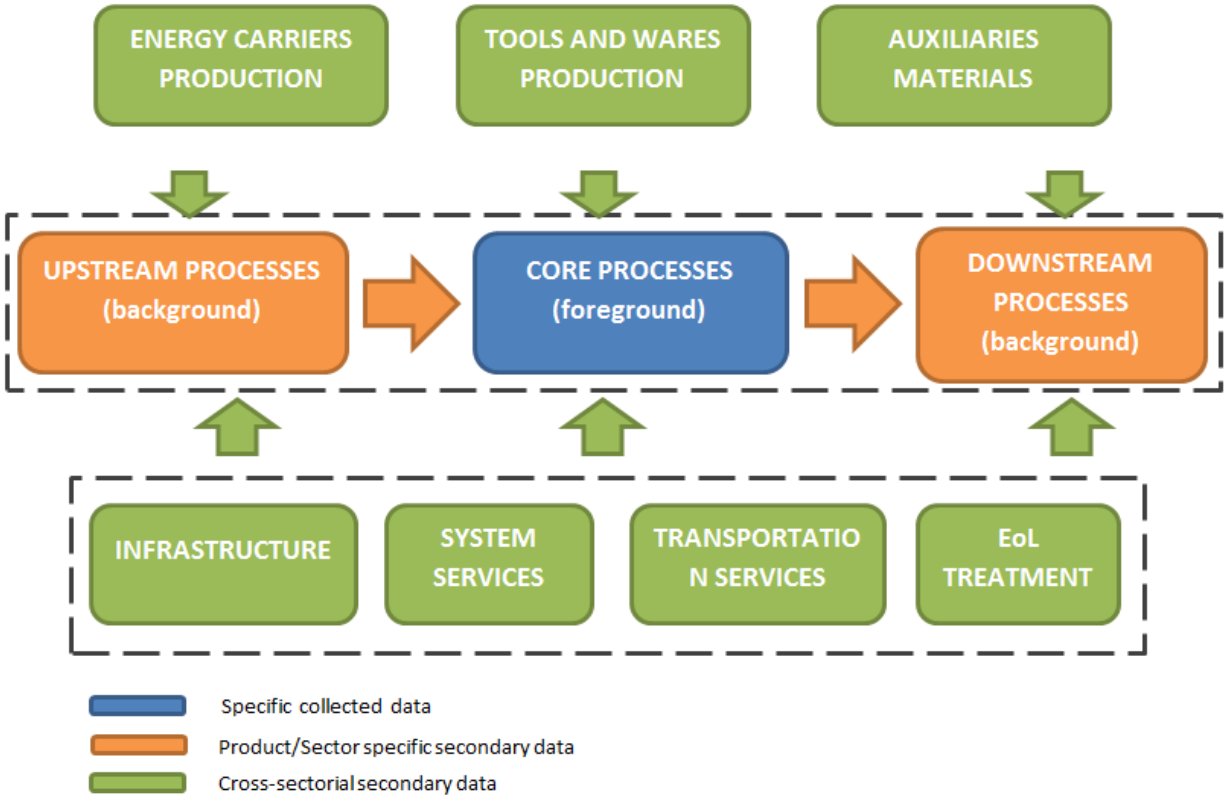

Figure 1, Data typology distribution in product life-cycle according to EF guides

4.2.2 Current situation of ELCD Database concerning the typology of data

Table 1 provides a classification of the ELCD II datasets within the defined data typology.

Table 1, ELCD data typology

Data Sector	Data Sub-sector	Number of datasets	Data Typology
End-of-life treatment	Energy recovery	28	Cross-sectorial
	Waste water treatment	5	Cross-sectorial
	Landfilling	12	Cross-sectorial
Energy carriers and	Lignite based fuels	66	Cross-sectorial

technologies	Heat and steam	87	Cross-sectorial
	Mechanical energy	12	Cross-sectorial
	Crude oil based fuels	5	Cross-sectorial
	Natural gas based fuels	1	Cross-sectorial
	Hard coal based fuels	1	Cross-sectorial
	Lignite based fuels	1	Cross-sectorial
Materials Production	Plastics	24	Product/sector specific
	Metals and semimetals	11	Product/sector specific
	Other mineral materials	6	Product/sector specific, Cross-sectorial
	Wood	4	Product/sector specific, Cross-sectorial
	Organic chemicals	6	Product/sector specific, Cross-sectorial
	Inorganic chemicals	6	Product/sector specific, Cross-sectorial
	Water	6	Cross-sectorial
Systems	Packaging	1	Cross-sectorial
	Construction	13	Product/sector specific
Transport services	Water	6	Cross-sectorial
	Air	2	Cross-sectorial
	Other transport	4	Cross-sectorial
	Rail	4	Cross-sectorial
	Road	6	Cross-sectorial
TOTAL		247	Cross-sectorial
		48	Product/sector specific
		22	Both

Energy carriers and technologies, end of life treatments and transportation services are considered as Cross-sectorial data, system services and materials can be considered either Product/sector specific or Cross-sectorial depending on the studied product/organization Life Cycle.

As shown in Table 1, most of the ELCD process data sets can be considered as Cross-Sectorial Secondary Data. Once the ELCD III will be launched, including around 120 new datasets, mainly Cross-sectorial, the total number of datasets will raise to 440.

However, this analysis underlines also the need to increase the availability of Product/Sector Specific Data.

Moreover, PEF and OEF guides proposes the following hierarchy for generic sources of secondary data::

1. Data developed in line with the requirements of the relevant PEFCRs or OEFSRs;
2. Data developed in line with the requirements for EF studies;
3. ILCD Data Network (giving preference to datasets that are fully compliant with the ILCD Data Network over those that are only entry-level compliant);
4. ELCD database.

It is crucial to increase the availability of Product/Sector Specific Data in all the listed sources.

4.2.3 Recommendations

Taking into account the hierarchy, as well as the current situation in ELCD, the priority should be the development of Product/Sector Specific Data in line with CRs and EF principle.

The launch of a public "Call for Data" (specially involving the members of the EPLCA Business advisory group) can potentially be useful to achieve this goal, and to generally increase the data availability.

Figure 2 describes a proposed workflow to launch this kind of Call for Data.

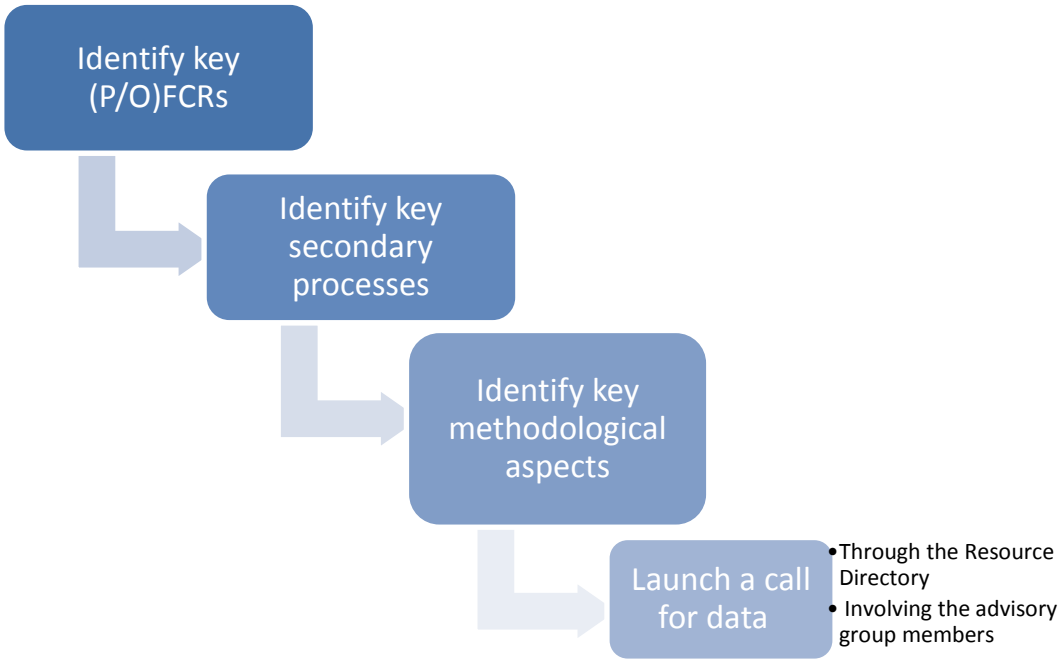

Figure 2, Increasing data availability proposed work-flow.

Key (P/O)FCRs as well as respective key Product/Sector Specific foreground processes should be identified. Specific methodological requirements could be defined in CRs, key aspects regards:

- Cut-off rules
- Allocation/substitution
- Infrastructure processes (not to be included)

The CRs also define the mandatory impact categories to be reported and for which the LCI must be complete.

In order to match these aspects in datasets development, a technical annex to the "call for data" should be produced. Datasets owner should set up a DN node and submit datasets to the ILCD DN and to the EF DN registries. This should be a mandatory requirement in the "Call for Data".

The call could be publically submitted (e.g. through the LCT Forum) or delivered to a selected number of members of the EPLCA advisory groups.

Additionally, training EPLCA advisory groups' members on the ILCD Format, the ILCD DN and the EF methodology is suggested within this report.

4.3 Data quality required by EF

4.3.1 EF requirements for data quality

Both PEF and OEF guides clearly consider the data quality as a key aspect, to be taken into account while selecting data to be used within an EF study.

Six quality criteria are adopted for EF studies, five relating to the data and one to the method. These criteria are summarised in Table 2. Besides these criteria, three more aspects are included in the quality assessment, i.e. review, and documentation (compliance with the ILCD format) and compliance with ILCD nomenclature. The latter three are not included within the semi-quantitative assessment of the data quality but have however to be fulfilled.

Table 2, Criteria and aspects to be considered when assessing quality of data for EF studies (European Commission, 2012f).

Data quality criteria		• Technological representativeness • Geographical representativeness • Time-related representativeness • Completeness • Parameter uncertainty • Methodological Appropriateness and Consistency
Additional aspects	**Documentation**	• Compliant with ILCD format
	Nomenclature	• Compliant with ILCD nomenclature (e.g. use of ILCD reference elementary flows for IT compatible inventories)
	Review	• Review by "Qualified reviewer": • Separate review report

Based on these data quality criteria, a semi-quantitative assessment of the overall data quality of the dataset shall be calculated summing up the achieved quality rating for each of the quality criteria, divided by the total number of criteria. The Data Quality Rating (DQR) result is used to identify the corresponding quality level. Formula 1 provides the calculation provision:

$$DQR = \frac{TeR + GR + TiR + C + P + M}{6}$$

Formula 1, DQR evaluation (European Commission, 2012e)

- *DQR* : Data Quality Rating of the data set
- *TeR: Technological Representativeness*
- *GR: Geographical Representativeness*
- *TiR: Time-related Representativeness*
- *C: Completeness;*
- *P: Precision/uncertainty;*
- *M*: Methodological Appropriateness and Consistency

The semi-quantitative assessment of the overall data quality of the dataset requires the evaluation of each single quality indicator.

Three of these criteria are context-specific and may be further defined in CRs: TiR, Gr and TeR. The other criteria are independent of the context: M, C and P.

4.3.2 Current situation of ELCD Database concerning data quality

Up to 175 datasets of the ELCD III are currently being reviewed against the ILCD Entry level requirements. During the revision a pre-evaluation of quality indicators have been performed on 31 ELCD datasets. Being C, P and M context-independent indicators, this pre-evaluation applies to any possible datasets use. Figure 3 shows how this evaluation have been reported in the review reports

ITEMs	Comments
	check for data outliers.
Completeness: "percentage of flow that is measured or estimated"; assessed on level of process	Assessed as good u[illegible] expert judgment. Declared cut off as follows: 99.9% of mass inputs and all non-mass inputs reported as included. Wastes of less than 1% by mass for a process not recorded unless treated outside the system. All upstream energy inputs included except compressed air which has a negligible contribution. 98% of upstream mass inputs included. 99% of emissions included on basis of environmental relevance.
Consistency: "qualitative assessment of whether the study methodology is applied uniformly to the various components of the analysis"	Assessed as good u[illegible] expert judgment. Study methodology appears to be applied consistently, for example, with respect to allocation procedures. Worldsteel uses secondary data including other trade association and GaBi data for some processes, for which it is more difficult to assess the extent of compliance with the worldsteel methodology.
Uncertainty of the information (e.g. data, models and assumptions).	Assessed as good [illegible] Having reviewed the methodology (as part of an independent review panel), model, assumptions and data, the level of uncertainty is judged to be low.

Figure 3, ILCD Entry-Level review report with quality indicator evaluation

Figure 4 shows the M, P and C quality indicator performance within 31 ELCD datasets.

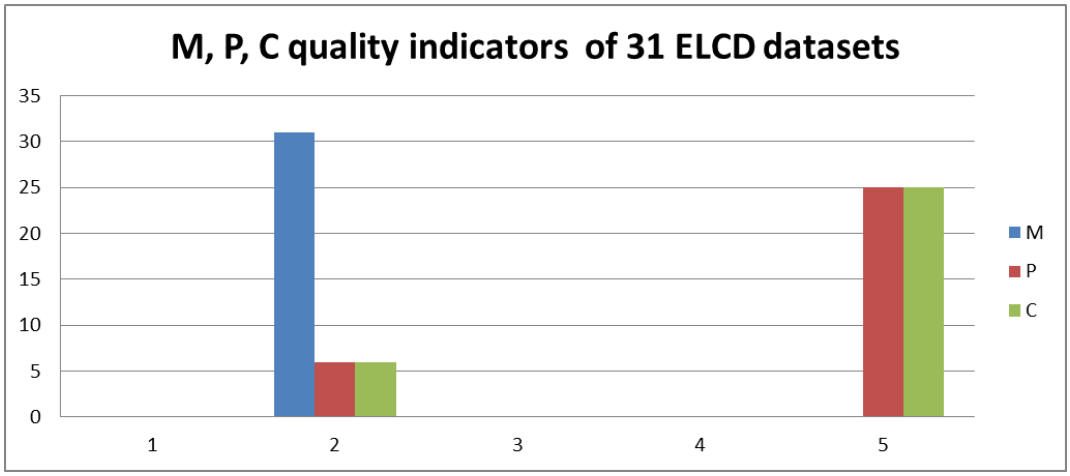

Figure 4: M, P, C quality indicators of 31 ELCD datasets.

C and P quality evaluation have been influenced by a lack of documentation of the datasets which did not allow performing the evaluation, 5 have been assigned to unknown quality indicators. This lack of documentation slightly affects ELCD datasets usability within EF studies.

Although context dependent, time related representativeness have been evaluated taking into account ELCD datasets validity in comparison to table 6 of the PEF guide (Figure 5).

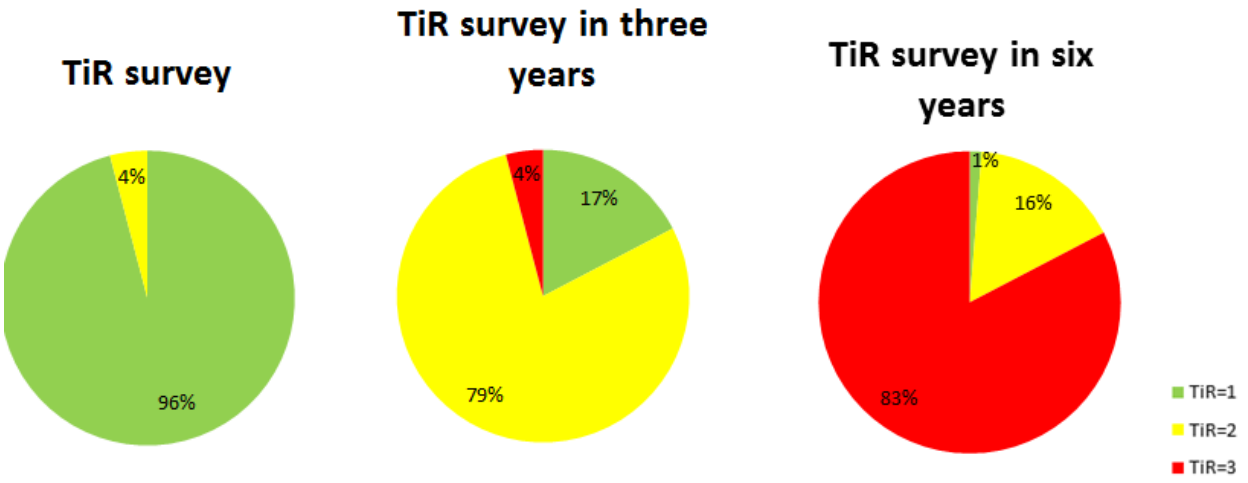

Figure 5: survey of ELCD Datasets current time representativeness, in three years and in six years.

The surveys show that the ELCD time representativeness will strongly decrease in the next 3 to 6 years. This will decrease datasets usability within EF study.

4.3.3 Identified implementation problems

The feedback on EF pilot projects that have been received, highlighted the evaluation of quality indicators as highly time consuming. Moreover, it was reported that a correct assessment of the completeness, Precision/uncertainty and methodological appropriateness and consistency was often hard to evaluate for data sets users.

4.3.4 Recommendations

Taking into account the ELCD quality level it is recommended to address this issue, strategic decision should be taken in the short period. One of the possible solutions would be to update/revise some ELCD datasets improving the documentation and uncertainty and completeness quality in the mid-term period.

The evaluation of completeness, Precision/uncertainty and methodological appropriateness and consistency quality indicators is not a trivial task. However, the experience made by JRC during the coordination of review of ELCD datasets against the ILCD Entry-Level requirements demonstrates this task to be is easier if made by the reviewer who is often supported by datasets providers.

Therefore, in order to reduce the time needed to evaluate the DQR at EF study level, is recommended to suggest (and eventually in a longer term to make it mandatory) to reviewers of datasets to pre-evaluate the purely dataset-specific quality criteria (i.e. completeness, Precision/uncertainty and methodological appropriateness and consistency) at the review stage and publish these results on the

review reports. As said, this pre-evaluation has been performed during the review of some ELCD Datasets demonstrating the feasibility of this approach.

The proposed approach could be achieved by slightly refining the ILCD-Entry level requirements document and the review template.

Although the proposed approach could bring several advantages to the application of the EF data quality requirements, differences between entry-level requirements and EF ones should be taken into account.

Even if the two quality requirements are very similar, some peculiarity, regarding especially methodological aspects and completeness, may bring to two different evaluations for the relative quality indicators. This consideration could be even emphasized when more specific rules would be defined by CRs. Quality indicators evaluated against EF requirements could differ to those ones evaluated against CRs requirements.

In our opinion the ILCD Entry-level requirements should not be replaced by stricter ones, while the latter should be developed and use in parallel. The development of alternative quality requirements, closer to EF ones, should lead to the creation of other Data Networks parallel to the ILCD one.

As the compliance with ILCD format, documentation and nomenclature are enforced in EF requirements, and in order to increase the availability of more quality-assured datasets, it is recommended to support the development of flows mapping files or conversion tools between other commonly accepted LCI data formats and the ILCD format. In particular, the Ecospold v2 format has been recognised to have the highest priority, due to its use within most common LCA software.

4.4 Development perspectives for the Data

As demonstrated in paragraph 4.2.2 the current ELCD II (and upcoming ELCD III), can already be considered as a comprehensive source of cross-sectorial secondary data. Currently, it is expected that up to 150 datasets will be compliant and will therefore be registered into the ILCD DN.

Other partners are currently being involved in the ILCD DN that, in the next future, will increase the availability of LCI datasets, facilitating high quality data search for users. The use of the ILCD DN as LCI data source will guarantee the coherence to the ILCD data format and nomenclature. The use of the ILCD DN will ensure minimum quality of the datasets. Moreover, Entry-Level requirements review reports, attached to ILCD entry-level compliant datasets, will facilitate the EF DQR evaluation.

As described in paragraph 4.3.2, the use of the Entry-Level requirements, the EF requirements and CRs requirements may also lead to divergent evaluation of datasets quality indicators. To address this issue, it might be necessary to develop in the future parallel Data Networks (cf. figure 6), each network using its own quality requirements. The following parallel data networks are currently foreseen:

- 1 data network for the ELCD (virtual distributed DB);
- 1 ILCD Data Network, using the ILCD Data Network entry-level requirements;
- 1 PEF Data network, using the EF quality requirements;
- n (P/O)EFCRs specific data networks, using n FCR specific quality requirements.

While the setting-up of an EF DN is already recommended by this report, the setting-up of (P/O)EFCRs Data Networks is recognized as very useful but not strictly necessary. The compliance to the EF quality requirements will guarantee that the documentation of datasets is compliant with the ILCD entry-level requirements (including information about methodology, completeness and precision). This means that the documentation should allow the users to identify those datasets which are compliant to stricter rules that could be put in place at the CRs level.

EF requirements can be considered stricter than ILCD Entry-level requirements which will lead the EF DN to be a subset of the ILCD DN. CRs quality cannot be less strict than EF requirements. CRs DNs would therefore be subsets to the EF D N and therefore of the ILCD D N. CRs could also overlap depending on Product/organization category.

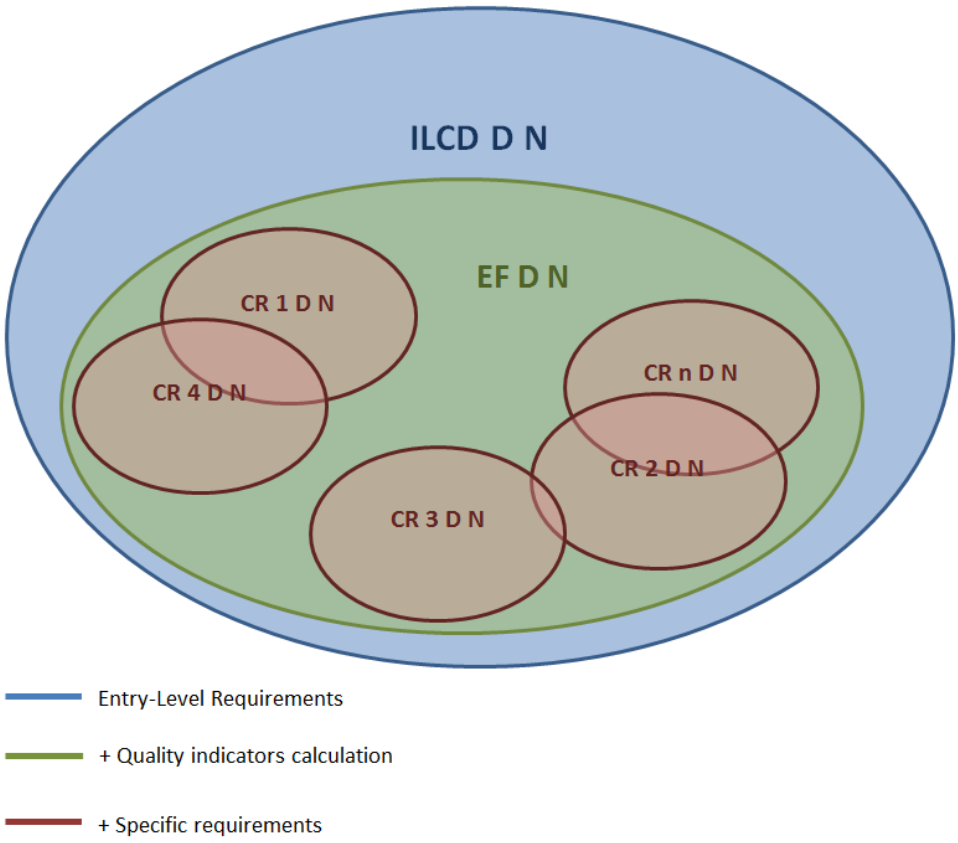

Figure 6, Mapping of datasets as being member of several Data Networks

The setting-up of a “no requirements” D N need to be further debated: although renouncing to quality requirements should be avoided as far as possible, this option could also lead to a wider cooperation among other country national database developers.

Another key aspect to be defined in the very next future is the role of JRC in the ILCD DN and in EF DN. JRC is currently the Acting administrator of the ILCD DN registry administrator for the launching phase. Who will be the administrator for ILCD D N and EF D Nin the future should be decided as soon as possible.

4.5 Analysis of "PFCR for Intermediate Paper Products" case study

4.5.1 Presentation of the PFCR

A case study on data selection and data quality assessment is presented in this paragraph. The aim of the case study is to illustrate and discuss the issues and the possible solutions discussed in previous sections. This example will be based on the PEFCR for Intermediate Paper Products (The Confederation of European Paper Industries, 2011).

The PEFCR describes Paper Products Life-Cycle and the system boundaries to be considered and defines foreground and background processes (figure 7). Infrastructure processes are implicitly included.

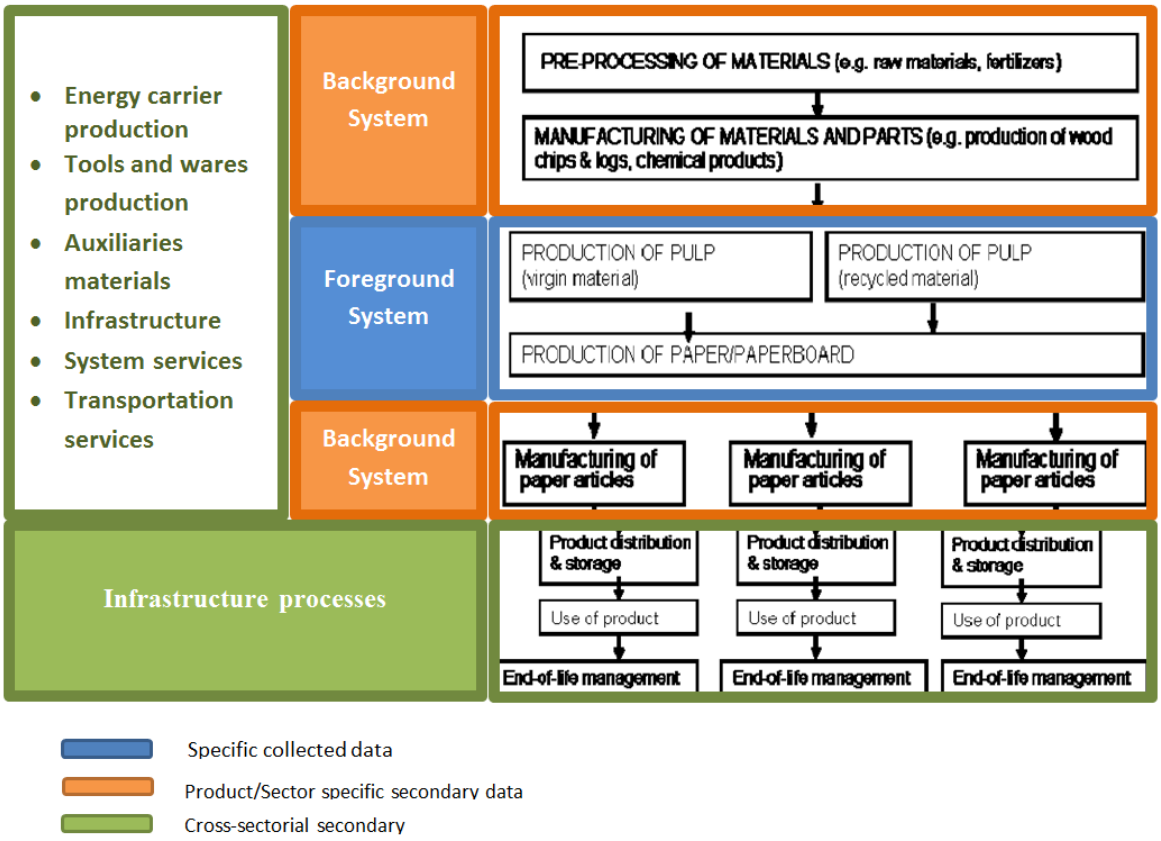

Figure 7, Data typology distribution in product life-cycle adapted from Paper Products PEFCR (The Confederation of European Paper Industries, 2011).

4.5.2 Analysis of the required data typology

The FPCR provide an example of the foreground processes that shall be considered:

- Transportation within and between extraction and pre-processing facilities, and to the production facility;
- Distribution and storage processes (e.g. warehousing and use of vehicles such as cranes);
- The production of fuels, electricity and heat (off-site production) used in the production;
- The production of chemicals used in pulp;
- The production of chemicals used in paper;
- The production of minerals used in paper;
- The production of process chemicals used in the pulp and paper/board production;

- The production of packaging material used in products (including for example paper, paperboard, plastic);
- Wood-based raw materials:
    - Production of pulp wood
    - Production of off-site woodchips
    - External production of pulp
    - Production of recovered paper

Most of these processes are not nor product neither sector specific but refers to the production of services and facilities that have been used during product or service life cycle.

As define in paragraph 4.2.2, the ELCD comprises of a comprehensive number of Cross-Sectorial Secondary (table 1) data that covers:

- Transportation
- Production of Fuels
- Production of Electricity
- Production of Heat
- Production of Steam
- Production of Packaging

ELCD also covers some product/sector specific secondary processes such as:

- production of chemicals
- production of minerals

Product/Sector Specific secondary data should be mainly used to cover the production of wood-based raw materials as defined in the PFCR and should be included in a potential “Call for data”.

Specific requirements defined in the PFCR should be addressed in the “Call for data” technical annex.

Most of the datasets of the ELCD that have been identified to be used within a Paper Product study have not being reviewed yet. For this reason, a quality assessment of those datasets cannot be performed within this case study.

5 Life Cycle Indicators - project overview and link to the ILCD system

The aim of developing indicators within the Life Cycle Indicators project (European Commission, 2012b) is monitoring European progress towards sustainability in terms of the environmental performance. These indicators need to provide an integrated view on the links between consumption, production, resource depletion, resource use, resource recycling, environmental impacts and waste generation. The approach that facilitates such integrated view and chosen for this development is based on the Life Cycle Thinking (LCT) concept and LCA methodology.

This framework allows for analysing the environmental impacts in terms of different impact categories as well as allows for the development of the overall environmental impact indicator. In addition, it permits to address the question of shifting of burdens outside Europe via trade.

Life cycle indicators assess the environmental impact of European production, consumption and waste management. The results of the indicators follow the logic of life cycle assessment and consequently can be presented at the different level of aggregation (Figure 8).

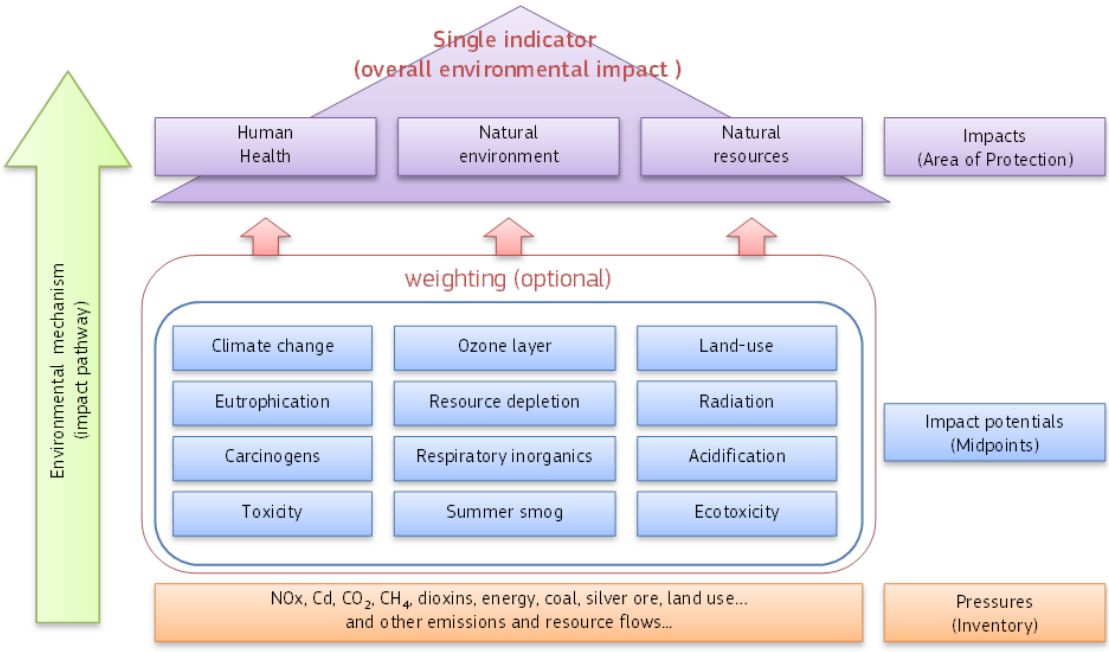

Figure 8, Assessing the environmental impacts at different level of aggregation (European Commission, 2012b)

The underlying indicator framework covers resources, products and waste being interrelated by the life cycles of products. While being macro-level, the indicators are developed using hybrid micro/macro methodologies and data: this way policies informed by these indicators can be effective and their implementation (e.g. Ecodesign improvements, Green Public Procurement and other improvements) can correctly be measured on macro-level.

This coherent framework gives a full picture of the environmental impacts related to the European consumption and production based on three types of indicators: resource indicators (European Commission, 2012c); basket-of-products indicators (European Commission, 2012a); waste management indicators (European Commission, 2012d).

The resource (decoupling) life cycle indicators monitor the total environmental impact of European Union, and of each Member State in relation to the resources used. The set of decoupling indicators can be applied – among others - to assess the resource use efficiency.

On the other hand, the basket-of-products indicators concentrate on the environmental impacts of the consumption which is represented by 15 products grouped in 5 demand categories (nutrition, shelter, mobility, consumer goods and services).

The Waste management indicators are not addressed in this report since they are considered as not relevant at this stage of development.

5.1 Resources Indicator

The resource life cycle indicators cover all emissions that happen on the territory of a Member State (or European Union as a whole) as well as impacts related to the imported products; the exported products are excluded (they are considered as the environmental impact in the countries that import them). The framework for resource life cycle indicators is presented at Figure 9.

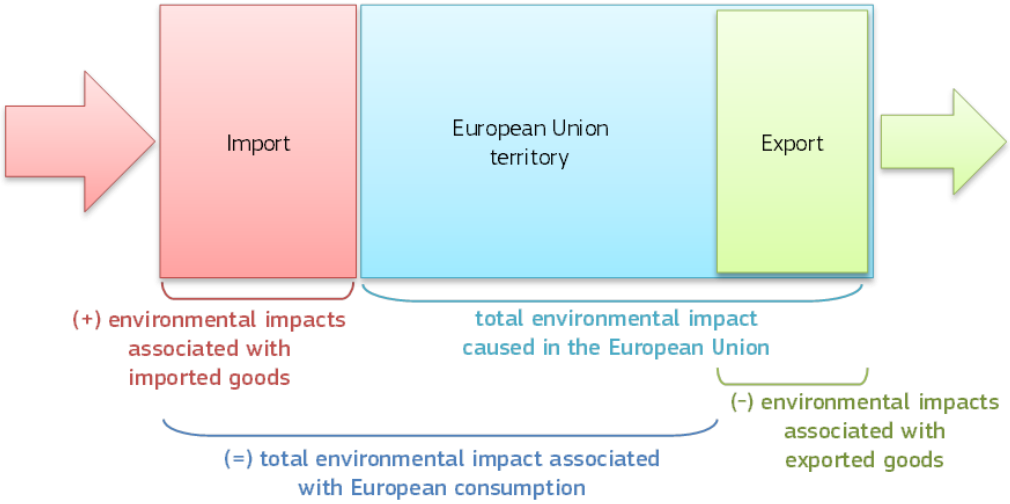

Figure 9. Resource life cycle indicators framework (European Commission, 2012b)

The European Union (or Member State) territorial emissions come from statistical data sources regarding the total emissions, whereas the export and import is estimated on the basis of selected 15 products representing the major part of the trade flows (Figure 10)

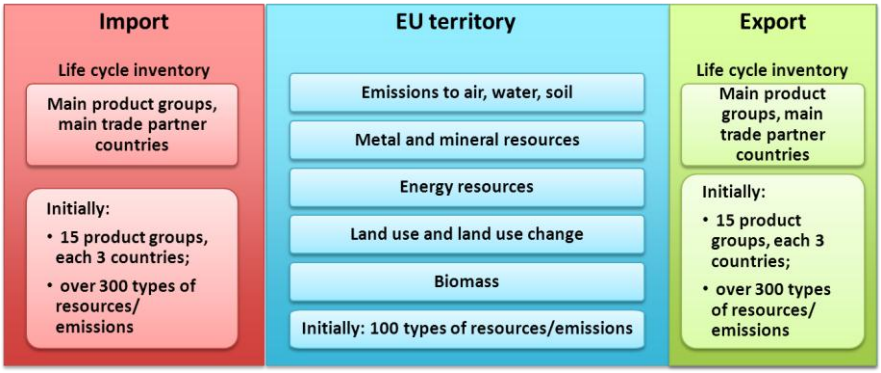

Figure 10. Coverage of the resources and emission in the total inventory and impacts (European Commission, 2012b)

The products considered in the analysis are presented in the Table 3 for import (together with 3 major source countries, and for export in Table 4.

Table 3, Primary import – example of EU-27 (European Commission, 2012c)

#	HS2 code	Product groups	Representative	CN8 code	Source country of imports		
					1.	2.	3.
1	27	Mineral fuels	crude oil	27090090	RU	NO	SA
2	72&73	Iron & Steel	non alloyed steel slaps or coils	72071210	RU	UA	MX
3	76	Aluminium	unwrought aluminium	76011000	RU	MZ	NO
4	61/62/ 63/52	Textiles/Cotton	t-shirts (Cotton)	61091000	BD	TR	CN
5	87	Road vehicles	passenger car	87032319	JP	KR	TR
6	39	Plastics	polyethylene bags	39232100	CN	MY	TH
7	84a	Machinery	air conditioning	84158190 (from 2006 84158100)	CN	TH	JP
	84b	Machinery	computer/laptop	84713000			
8	85	Electrical machinery	video recording or reproducing apparatus	85219000	CN	ID	TR
9	26	Ores	iron ore	26011100	BR	AU	MR
10	28	Inorganic chemicals	aluminium oxide	28182000	JM	SR	BA
11	31	Fertilizers	urea	31021010	RU	EG	HR
12	29	Organic Chemicals	methanol	29051100	CL	RU	LY
13	17	Sugar	cane sugar	17011110	BR	MU	FJ
14	23	Residues and waste from the food industry	soya oil cake	23040000	AR	BR	
15	02	Meat	bovine meat boneless	02013000	BR	AR	UY

Note: AR – Argentina, AU – Australia, BA – Bosnia and Herzegovina, BD – Bangladesh, BR – Brazil, CL – Chile, CN – China, DE – Germany, EG – Egypt, HR – Croatia, ID – Indonesia, JM – Jamaica, JP – Japan, KR – Republic of Korea, MR – Mauritania, MU – Mauritius, MX – Mexico, MY – Malaysia, MZ – Mozambique, NO – Norway, RU – Russian Federation, SA – Saudi Arabia, SR – Suriname, TH – Thailand, TR – Turkey, UA – Ukraine, UY – Uruguay

Table 4. Primary export – example for EU-27 (European Commission, 2012c)

#	HS2 code	Product groups	Representative	CN8 code
1	72&73	Iron and steel	Hot rolled non-alloyed steel	72085120
2	27	Mineral fuels	Crude oil	27090090
3	87	Road vehicles	Passenger cars	87032319
4	39	Plastics	Propylene	39021000
5	84a	Machinery	Self-propelled excavators	84295210
	84b	Machinery	Data processing machines	84714990 (from 2006 84714900)
6	76	Aluminium	Alloyed aluminium sheets	76061291
7	47&48	Pulp and paper	Paper and paperboard	48101990
8	85	Electrical machinery	Electric motor parts	85030099
9	31	Fertilizers	NPK fertilizer	31052010
10	17	Sugar	White sugar	17019910
11	4	Dairy	Milk and cream in solid forms	04021019

12	2	Meat	Frozen boneless swine meat	02032955
13	28	Inorganic chemicals	Aluminium oxide	28182000
14	29	Organic chemicals	Caprolactam	29337100
15	25	Minerals	Portland cement	25232900

5.2 Basket of products Indicators

The basket-of-products indicators (European Commission, 2012a) reflect the environmental impact and the resource consumption associated with the final consumption of an average citizen in the EU-27. These environmental impacts refer to the entire life cycle of chosen basket of goods and services. The indicators are based on apparent final consumption and cover several demand categories (nutrition, shelter, consumer goods, mobility and services), considering a range of specific product groups that meet these demand.

The calculations combine the data on life cycle emissions, resource consumption, and environmental pressures for products with expenditure and consumption statistics. As the referenced statistics represent domestic consumption only, the impacts of domestic production for export are excluded. The impacts of foreign production for domestic consumption are included by using country-specific life cycle data for the top import countries for each product as identified by trade statistics.

The products chosen for the basket are representative in terms of the environmental impact and volume consumed for 5 consumption categories: nutrition, shelter, mobility, consumer goods and services (omitted in the pilot calculations). For each of the consumption category the most important products are considered. 15 products are currently considered.

Table 5. Products chosen for the pilot calculations of the basket of products (European Commission, 2012a)

Consumption category	Product group	Product
Nutrition	Meat and seafood	Beef, pork, poultry
	Dairy products and eggs	Milk, butter, cheese
	Crop-based products	Sugar, vegetable oils & fats
	Vegetables	Potatoes
	Fruits	Apples, oranges
	(Non-)alcoholic beverages	Coffee, beer
Shelter / private housing	Single-, two-family and terrace houses	Single house
	Multi-family houses	Multi-family house
	High-rise buildings	High-rise building
Consumer goods	Clothing	Shoes, cotton shirt
	White goods	Washing machine, refrigerator, dish-washer
	Consumer electronics	Laptop
Mobility	Private transport	Mid-class car
	Public transport	Travel by train, bus and plane
Services	Bars & restaurants	(Omitted from this study)
	Leisure activities	(Omitted from this study)
	Education	(Omitted from this study)
	Tourism	(Omitted from this study)

5.3 How ELCD and ILCD currently support LC Indicators

The life cycle indicators follow the life cycle assessment methodology in many aspects: consideration of the whole life cycle, LCI preparation, classification of substances to relevant impact categories, and finally calculation of the environmental impacts within each impact category. These tasks have been performed taking into account ILCD components (e.g. reference flows).

5.3.1 Data

The EU-27 inventory is based on macro-level statistical data combined with specific LCI data sets. Environmental impacts associated with exports or with imports are derived from macro data, multiplied by LCI data per unit commodity (e.g. kg CO_2 per tonne imported cement to obtain the total imported CO_2 emissions of cement). Domestic (EU-intern) emissions are predominantly derived from statistical macro data (e.g. territorial greenhouse gas emissions), but complemented with data from other sources. (European Commission, 2012b)

The inventory comprises:

- Statistical macro data related to import/export activities;
- Statistical macro data related to domestic (EU-intern) emissions;
- LCI data.

LCI data availability plays a fundamental role in the selection of the sub-product groups. The selection of the sub-product groups and specific products within these groups must find a balance between environmental relevance and LCI data availability. The choice of the products was supported by LCI data from ELCD that have been used as preferential data source.

5.3.2 Nomenclature

The inventories of LC Indicators should capture comprehensive and detailed information (i.e. elementary flows) on resource use, which allows for calculating different impact categories. Following the pragmatic approach taken in the project with regard to data availability and in view of the broader resources definition of the Thematic Strategy on the sustainable use of natural resources, the inventories comprise[1]:

• Emissions to air, water and soil

• Material use

• Water consumption

• Land use, land use change, and

Life cycle inventory (LCI) data need to be in a consistent format for territorial resources/emission as well as for imports and exports of goods and services. Therefore the matching of elementary flows (resources and emissions) is important so that statistical data and LCI data do follow a common nomenclature. The reference data included in the life cycle inventory can then be used to evaluate and

compare relevant impacts of e.g. imported or locally produced products with reference to the products' volume or weight (e.g. kg CO2, methane, nitrate etc. emissions per kg imported wheat). To be consistent with other developments, the ILCD reference elementary flows (European Commission, 2010b) and related nomenclature (European Commission, 2010e) is being used. Using the ILCD reference elementary flow list in the data sets that are applied in this project could also ease the use of data sets from the ILCD Data Network in the future.

A complete list of flows to be accounted can be found in the LC Indicators technical reports. In the LC Indicator prototypes that have been developed, 1279 flows have been accounted, all of them belong to the ILCD reference elementary flow list.

5.3.3 Impact Assessment methods

The impact assessment methodologies for the relevant impact categories are taken from the draft ILCD Handbook recommended LCIA methods (European Commission, 2010f; European Commission, 2012b). Comprehensive information on the chosen methodology per impact category, and the corresponding factors, is provided in the ILCD Handbook (European Commission, 2010d).

- resource depletion,
- land use,
- climate change,
- ozone depletion,
- photochemical ozone formation,
- acidification,
- eutrophication,
- human toxicity (including cancer and non-cancer effects), and
- ecotoxicity.

The above list is based on the ILCD recommended impact categories and the LCIA datasets are available in the ILCD format.

5.4 Recommendations

The use of ELCD data sets within indicators calculation is preferred, as developing the prototypes additional data sets for products and materials, as well as end-of-life treatment data sets, have been required (European Commission, 2012b). In order to increase the number of the considered products and to overcome some methodological limitations additional and more specific data sets should be developed in the future. Moreover, in view of capturing the overall environmental impacts of traded products, the referenced LCI data should be country specific.

The launch of a public "Call for Data" similar to the one proposed in paragraph 4.2.3 (specially involving the members of the EPLCA Business advisory group) can potentially be useful to achieve this goal, and

to generally increase the data availability. The involvement of member state LCA national network and National Databases providers in the ILCD DN is recommended in order to increase the availability of more representative country specific LCI data sets. As the result, the number of products covered in the resource indicators and basket-of-product indicators could be increased significantly so that more reliable indicators are produced.

The use of the ILCD reference elementary flow list and the ILCD nomenclature in the LC Indicators project facilitates the use of the ILCD Format. A key future development that is in progress is the development of ILCD data sets to store data within the project. While LCI inventories data can be implicitly stored in the ILCD format, LCIA results data sets may be produced to increase the ability to share result with stakeholders. So called “Impact results flows” may be developed in the future to support the development of LCIA results Data sets.

Data quality plays a fundamental role in developing reliable sets of indicators. In general, and for updates of the LC Indicators project in particular, referencing ILCD Data Network Entry-Level requirements will ensure an independent evaluation of the achieved data quality, including representativeness and possible uncertainties.

6 Conclusions and Perspectives

The current use and needs of the ILCD DN and of the ELCD supporting the EF and the LC Indicator projects providing coherent data and increasing their usability and consistent application to the European context have been investigate within these report. Recommended future development have been investigated and reported as well. EF and LC Indicators project key data related features have been analysed defining how the ELCD and the ILCD DN are currently used within this contexts and highlighting recommended improvements and developments.

EF and LC Indicators project data related features have been analysed and links to ELCD and ILCD DN have been highlighted. The analysis underlines how the ELCD and the ILCD DN could effectively support the application of the EF methodology and LC Indicators evaluation increasing data availability and facilitating data quality management.

The ELCD demonstrate to be a quite comprehensive source of Data. The ELCD and the ILCD DN are already listed as preferential data sources in EF guides and in LC Indicator technical reports. Nevertheless data availability needs to be increased extending the ELCD database or involving partners in the ILCD DN. Recommendation on the strategy to be followed to fulfil this need have been provided within this technical report. A process to evaluate and increase data quality within the ELCD and through the ILCD DN has already been established increasing EF and LC Indicators project applicability and reliability. Future actions that could be taken in this sense have been defined.

Based on this analysis and the recommendations, it is suggested to define in the next months a precise roadmap for maintenance and further development of the ELCD and the ILCD DN for the next three year.

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ILCD Data Network and ELCD Database: current use and further needs for supporting Environmental Footprint and Life Cycle Indicator Projects

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